

Use of the Blanchard Mechanotherapist In Treating Postoperative Atelectasis

O. LEONARD HUDDLESTON, M.D., PH.D.,* *Los Angeles*

THE majority of patients following thoracic surgery recover rapidly and atelectasis of the lung tissue lasts for a relatively short period of time. Complete reexpansion of partially atelectatic lung tissue may be brought about rapidly by a combination of treatments consisting of displacement of fluid and air from the intrapleural space, establishment of a negative intrapleural pressure, and periodic development of a positive intrapulmonic pressure as a result of repeated coughing. Therapeutic exercises involving bilateral symmetrical exercises of the chest and shoulders may be employed also to assist in the reexpansion of the lung tissue. Even in spite of these therapeutic procedures, a certain number of patients will be found on x-ray examination to possess incomplete reexpansion of the remaining lung parenchyma.

A limited study was made on a small group of such patients selected from the surgical wards of a large army hospital which has been designated as a chest surgery center. An additional therapeutic measure was instituted to aid in the reexpansion of the lung tissue. This consisted in the use of the Blanchard Mechanotherapist to supplement breathing exercises. The diagnoses of the 13 patients in whom the studies were made include the following: there were five cases of bronchiectasis, four cases of empyema of the thorax (unilateral), one with an abscess of the lung, one with a mediastinal tumor, one with a pericardial cyst, and one with pulmonary tuberculosis.

In all instances a thoracotomy of the chest wall was made and either excision of the diseased or abnormal tissue made or a large open drainage of the chest established. A series of measurements of the chest was made daily on each patient. These consisted of measuring the diameters of the chest wall on the normal and abnormal sides; the points for successive measurements were determined and marked on the chest wall, namely, at the lower border of the manubrium at the parasternal line, at the nipple line in the mid-clavicular line, and at the level of the ninth rib in the mid-axillary line. The transverse diameter was measured at the level of the ninth rib in the mid-axillary line, and the circumference of the chest was measured at the same levels as those for the antero-posterior diameters. Vital capacity measurements were made by means of a spirometer. All measurements were repeated at the beginning and the end of each treatment, and the total treatment period lasted from seven to ten days.

Physical examinations showed a restriction of movement of chest wall on one side. There was a definite lag in the excursion of the chest wall on the operated side during inspiration in all of the patients. Nine patients showed a limited expansion of the chest on the right side and four on the left.

METHOD

The treatment routine employed in this study was as follows:

1. Initial chest measurements and vital capacity determinations were made and recorded.
2. The patient was placed in the posterior shell of the plastic chestcage of the Mechanotherapist. Sand bags and towels were applied to the chest on the normal side to a height sufficient to restrict the respiratory movements of the normal hemithorax when the front shell of the plastic cage was applied. The purpose of this procedure was to limit the excursion of the chest wall on the normal side and thus force respiratory excursions of the operated side. (It is believed that with a greater expansion of the chest, the intrapleural pressure should become more negative and a greater expanding force subjected to lung parenchyma.)
3. The patient was then instructed to remain more or less passive and to synchronize his breathing with the rate and rhythm of the artificial respirator. Actually, however, the rate of the machine was usually adjusted to coincide closely with that of the patient. Passive breathing by means of the respirator was continued for five minutes.
4. Following this, the patient was instructed to forcefully expand and retract his chest wall during alternate periods of deep inspiration and expiration. He was instructed also to concentrate on moving the chest wall on the operated side. Forced breathing assisted by the machine was continued for five minutes.
5. Alternate periods of quiet and forced breathing, within the respirator, of five minutes duration each were continued during a thirty minute period daily. This constituted a single treatment.
6. Following the discontinuation of a treatment, the measurements of the chest diameters and the vital capacity determinations were repeated and recorded. This procedure was carried out daily six days a week.

RESULTS

The results obtained in this series of patients are shown in Table 1.

It will be observed that the restricted motion of the chest was partially corrected in every patient. All 13 patients showed an increase in the antero-

* Director of Physical Medicine, University of Southern California School of Medicine and Los Angeles County General Hospital. Former Chief of the Physical Therapy Section at the Fitzsimons General Hospital, Denver.

TABLE 1.—*Results Observed in Thirteen Patients Treated Daily With the Blanchard Mechanotherapist Based on Measurements Made at the End of One Week of Treatment**Data Related to Comparative Measurements on the Affected Side Only*

	RIGHT CHEST Antero-posterior diameter			LEFT CHEST Antero-posterior diameter		
	Manubrium	Nipple	9th Rib	Manubrium	Nipple	9th Rib
Increase	9	5	3	3	4	3
Decrease	0	1	4	0	0	1
No Change	0	3	2	1	0	0

	TRANSVERSE DIAMETER			VITAL CAPACITY	
	9th Rib	Manubrium	Nipple	9th Rib	
Increase	6	9	10	4	12
Decrease	3	1	1	7	1
No Change	4	3	2	2	0

posterior diameter of the chest at the level of the manubrium, nine showed an increase at the nipple line, and six showed an increase at the ninth rib. Changes in the antero-posterior diameter of the chest wall at the level of the ninth rib were inconstant, and for the present no satisfactory explanation can be offered to account for the irregularities; six showed an increase, five a decrease, and two no change. Measurements of the transverse diameter at the level of the ninth rib showed the following: six patients showed an increase, four showed no change, and three showed a decrease. A decrease in the circumference at the level of the ninth rib was noticed in seven patients, four showed an increase, and two no change. Nine patients showed an increase in the circumference at the manubrium, ten at the nipple line, and four at the level of the ninth rib. At these same levels there were no changes in the circumferences in three, two and two patients, respectively, whereas a decrease in the circumference was observed in one, one and seven patients, respectively.

Although the observations using this method of treatment have been made on relatively few patients and the treatments were employed for a short time, the results appeared quite encouraging. The patients reacted very favorably to the treatment and appeared to be improved subjectively. The lag of the chest wall during the respiratory period was abolished, and definite evidence of an increase in the excursion of the chest wall was observed in the majority of patients. It has been concluded that the treatment is beneficial in promoting the recov-

ery of the functional control of the chest and of reestablishing proper ventilation of the lung. It would appear also from these observations that the excursion of the chest wall on the restricted side may be increased and the vital capacity enlarged. It is strongly suggestive that the treatment assists reexpansion of the lungs. Roentgenological examinations showed reexpansion of the atelectatic lung tissue, but it cannot be claimed that the pulmonary changes were brought about entirely by the treatment nor can the exact amount of benefit be ascribed to the use of the machine. However, it is my opinion that some beneficial results were supplied by the treatment because of the fact that the patients selected for the study were those that appeared to be refractory to other forms of treatment, and the state of partial collapse had persisted for a considerable period of time (one to three weeks).

Further observations have been made on a larger number of patients since the completion of this preliminary study and have been carried out over a longer period of time (four to six weeks in some patients). A complete analysis of the data thus obtained has not been made to date, but general indications are that the results largely support the conclusions arrived at in this preliminary study.

SUMMARY OF CONCLUSIONS

1. A series of observations has been made on therapeutic effects of the Blanchard Mechanotherapist on a group of 13 patients in whom reexpansion of the lung was incomplete following thoracic

surgery. The chest operations involved either an extensive thoracotomy with open drainage (two patients) or a thoracotomy with excision of the diseased or abnormal tissue (eleven patients).

2. Vital capacity determinations and measurements were made of the chest wall in the antero-posterior and transverse diameters, and the circumferences of all patients before and at the end of each treatment.

3. Each patient was treated 30 minutes daily for one week or more. Restriction of the excursion of the normal side of the chest was accomplished by means of sand bags and towels placed between the chest wall and the anterior shell of the plastic cage. Patients were instructed to force breathe while synchronizing the rate and rhythm with the alternate phases of compression and rarefaction of the air within the plastic shell of the respirator.

4. Twelve of the thirteen showed an increase in

the antero-posterior diameter of the chest at the level of the manubrium; nine at the level of the nipple line; six at the level of the ninth rib.

5. All patients showed a disappearance of the lag of the anterior chest wall on the operated side, the excursion of the chest wall on the two sides becoming equal and synchronous.

6. All patients stated that they felt better at the end of the treatment period, and there was a disappearance of any signs of dyspnea which may have been present at the beginning of the treatment.

7. It is concluded that the Blanchard Mechanotherapist provides a beneficial type of treatment which may be used to assist in establishing normal pulmonary ventilation and in reexpanding the lung in patients having residual postoperative atelectasis following surgery.

Fatal Myocarditis With Complete Heart Block From Diphtheria

R. A. KOCHER, M.D., *Carmel*

DIPHtheria, as is well known, if not treated promptly and sufficiently with antitoxin may cause serious myocardial damage. Such cases are now rarely encountered and this is remarkable when we note that less than two generations ago Aschoff¹ reported that 10 to 20 per cent of all cases of diphtheria showed parenchymatous degeneration of the heart muscle. This improved condition may be credited to the early recognition of the disease and the prompt treatment with antitoxin. Of 60 patients with diphtheria treated with antitoxin at the 203rd General Hospital, United States Army, during 1944-45, none showed any clinical evidence of heart involvement.

Outside this series, a German prisoner of war with diphtheria, for which no antitoxin had been given (he had been taken prisoner on the sixth day of the disease), entered our service at a stage when grave damage to the heart already had occurred. Because of the severity of the heart damage, manifest by clinical symptoms and the series of electrocardiographic tracings characteristic of heart block, later confirmed by post-mortem examination, this case is here reported.

CASE REPORT

A German prisoner of war, 29 years old, was admitted to the hospital with complaints of pain in the left cervical region, swollen neck glands and inability to swallow. Six days before admission he first developed sore throat for which he used pills and gargles. Twenty-four hours after onset, swelling in the neck began and became progressively worse until it became very painful to swallow. He was in seriously ill condition when picked up by American troops and sent to the hospital.

On admission there was intense edema of the soft palate and left posterior pillar. The posterior pharyngeal space was greatly inflamed and frank pus was present. Because of the appearance of the throat the admitting officer entered the patient on the surgical service where an incision was at once made between tonsil and capsule on the left. Diphtheria was not suspected and no smear or culture was taken on the day of admission.

On the day following admission the patient showed bradycardia, a pulse rate of 42 and temperature of 36.3 C. The throat now appeared covered with a gray gangrenous exudate over left tonsil and pillar. A throat culture was taken at this time and the patient was transferred to the medical service. The blood pressure was 85 systolic, 70 diastolic; respiration slow and often sighing. On this same



Fig. 1.—Electrocardiogram, four leads; showing complete dissociation of auricular and ventricular complexes. Auricular rate 110, regular; Ventricular rate 30, irregular. Eighth day from onset of diphtheria.